Architecture Differences between Cloud and Fog Computing in Internet of Things

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Abstract

Internet adopted the two technologies namely cloud and IOT. To make revolution in the current period Cloud computing gives hope to IOT. FOG computing is basically an extension of cloud computing services.

In this paper, we have introduced the topics I.e. cloud computing and FOG computing. After the introduction, we have discussed the architecture of IOT which includes both the three level architecture as well as the five level architecture. After the brief introduction of cloud computing, we have focused on the limitations of cloud computing that justifies why we shifted to the FOG computing which an extension to the cloud computing.

Before concluding the paper, we have highlighted a few challenges that we might have to face in FOG computing according to the references that we have included in our paper.

Keywords: Internet of Things, cloud computing, fog computing.

Introduction

Internet of things- Connecting everyday things embedded with electronics, software & sensors to the internet enabling them to collect and exchange data. IoT continuously monitoring your health. As any irregular condition is monitored, hospital is notified. Quickly the ambulance is send to the patient based on his reports. Internet of things basically expanding interdependence of humans to interact, contribute & Collaborate with things around us.

Benefits of IoT Efficient utilize the resources. It also minimize the human effort (eg Smart homes) It also save time if it minimize the human effort. Development of AI through IOT

Iot Features – Iot let us achieve the true potential of technology

1 Connect

A) Device Virtualization

Standardize integration of devices with the IoT enterprise

B) High speed messaging enable reliable secure & bidirectional communication between devices and the cloud.

C) End point Management Manage device endpoint identity, metadata and lifecycle state for all devices.

2 Analyze

a Stream Processing real time analysis of incoming data streams with event aggregation, filtering & correlation

b Data enrichment Enrich raw data streams with contextual information and generate composite streams.

c Event Store Query and visualize massive amounts of data with Integrated BI cloud Service supports and enable data analysis

3 Integrate

a Enterprise connectivity – Dynamically dispatch critical IOT data and events to applications and process flows.

B Rest APIs API-based Integration with cloud apps and IOT device.

C Command and control – Send message to devices from enterprise and mobile apps, independent of device connectivity

Cloud computing in IOT

In some system architectures the data processing is done in a large centralized fashion on cloud.
Once I have the information I pass it on to the cloud platform which in turn processes it and also have various applications to deal with the process information for that matter.
This doesn't require any immediate action but requires large amount of processing for that segment.
If we need immediate response we go for Fog computing.

Limitation of cloud computing

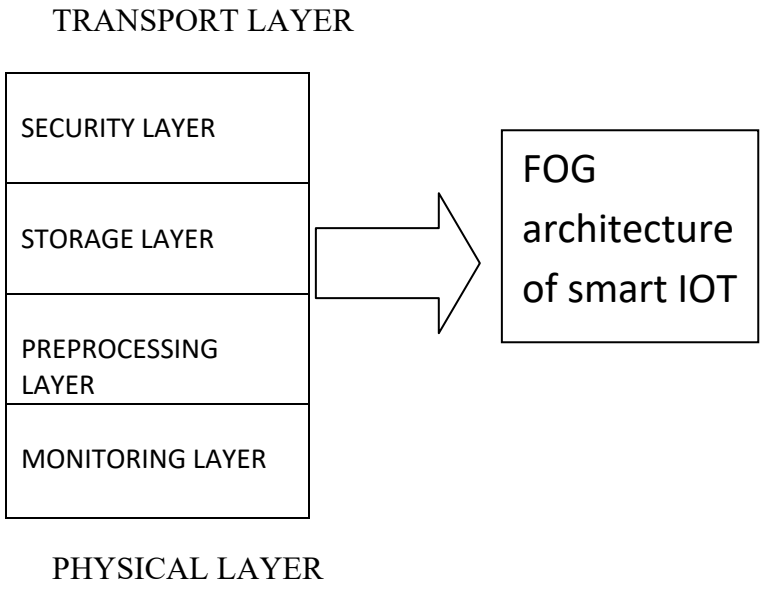
1. **Mobility:** Smart devices are mobile and network conditions make communication difficult.

2. **Reliable and real- time actuation**: Latency sensitive applications need real time responses.

3. **Scalability**: Multiple devices increase the latency.

Fog architecture

Fog architecture presents a layered approach which inserts monitoring, processing, storage and security layers between the physical and transparent layers. Fog architecture is used we need immediate response but in fog computing we have to be sure about the high security feature.



Monitoring and preprocessing are done on the edge of network before searching data from cloud.

Monitoring Layer: this layer monitors power, resources, responses and services.

Pre-processing layer: this layer performs filtering, processing and analysis of sensor data.

Temporary storage: this layer provides storage functionalities such as data replications, distribution and storage.

Security: This layer performs encryption, decryption and ensures data integrity.

Features of Fog Computing:

- **Low Latency**: less time required to access computing or storage resources.
- **Distributed Nodes**: fog nodes are distributed, which provide services to mobile devices.
- **Mobility**: Smart devices can communicate to smart gateway present in proximity.
- **Real-time Response**: Applications with high latency requirements receive real-time response from fog nodes
- **Interaction with Cloud**: The data which needs high processing is sent to cloud.

Basic architecture

There is no single consensus on architecture for IOT, which is argued universally.

Application Layer- responsible for delivering application specific services to the users defines applications in which the IOT can be deployed.
Network Layer- this layer is responsible for connecting smart things, network devices and services and processing sensor data.

Perception layer- sensors sense and gather information about the environment, senses physical parameters or identifies other objects in environment.

5 layer architecture

Following are the layers:

Business Layer: - Manages the whole IOT system, including applications, business and profit models and users privacy.

Application layer:- responsible for delivering application specific services to the users, defines applications in which the IOT can be deployed.

Processing layer:- stores analyses and processes huge amount of data. This layer also employs databases, cloud computing and big data processing modules.

Transport layer: - this layer transfers the sensor data between different layers through networks such as Bluetooth, wireless, RFID ,3G, LAN, and NFC.

Perception layer- sensors sense and gather information about the environment, senses physical parameters or identifies other objects in environment. Sensors are small in size, low cost and consume low energy.

Challenges

Security is the main issue in both cloud as well as the fog computing. Fog computing, has a number of challenges due to its architectural design between the physical and transport layer which we mentioned above For example, due to its distributed feature, it is susceptible to trust and authentication issues.

Let suppose we have a traffic signal completely based on Internet of things. Fog computing gives me the better result than the cloud computing. Security here is the main aspect because it gives us frequent response but anyone can manipulate according to their need.

Conclusion

In this paper we discuss the main features of fog computing and discuss the limitation of cloud computing e.g. latency. From this paper we conclude that fog computing is always better than cloud computing where we need low latency. Fog computing always gives us instant response and it monitors each of its resources and power consumption. Fog computing also instant filters the information which is necessary for us at particular moment.

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